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1,079,766



# PATENT SPECIFICATION

DRAWINGS ATTACHED

1,079,766

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## COMPLETE SPECIFICATION

### Clamping Device for Connecting Sheets of Material

We, ABEMA ALUMINIUM-, BEHÄLTER- UND MASCHINENBAU G.M.B.H., a German Body Corporate, of 20, Johannisbollwerk, Hamburg 11, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a clamping device for connecting two sheets of material at two adjacently positioned laterally projecting edge flanges thereof, including a rod for positioning between the edge flanges to form a reinforcing rib.

Various procedures are employed to assemble thin sheet-metal walls, for example, in the construction of storage tanks, vehicle bodies, silos and packing containers; examples are screw connections with sealing inserts, and riveted or welded connections. When employing such procedures it is difficult to assemble at the building site, large sheet-metal walls which cannot for transport reasons, be prefabricated as whole units. In one of these known procedures the edges of two sheets of material to be connected are bent back and connected to each other to form a reinforcing rib. In this process a rod is inserted between the bent-back edges and the bent-back edges and the rod are screwed together.

It is an object of the present invention to provide a device for connecting sheets of material, which will also result in a reinforcing rib being provided at the join but which will require neither welding nor screw or rivet connections.

According to the invention there is provided a clamping device of the kind referred to, in which the rod has a wedge-shaped cross section and the device further comprises an elongated generally U-shaped clamping member defining a groove with inclined side walls receiving the rod with play so that the edge flanges of the sheets are insertable between opposite side walls of the groove and

the rod, and a screw extending through the web of the U-shaped clamping member for exerting a force on the rod urging it in the direction towards the narrower side of said groove. The screw may be so arranged that it acts in the plane of symmetry of the wedge-shaped cross-section.

In a device constructed according to the invention, the width of the longitudinal groove in the clamping member may increase inwardly or outwardly towards the open side thereof and the screw may correspondingly exert a force in the direction towards either the narrower open or the narrower closed side of the groove, as the case may be, on the rod inserted in the groove.

In the former case the screw may be arranged in a threaded hole formed in the web of the grooved clamping member and may exert a force, by means of its end, on the inner transverse surface of the rod inserted in the groove of the clamping member.

The angle of inclination between the wedge faces of the rod (and of the clamping member) and the plane of symmetry of the wedge may amount to substantially 15°.

The clamping member and the rod may be made of any material; the most advantageous arrangement would be for the clamping member to comprise a metal strip and at least one surface layer of a softer material; furthermore the rod may be made of resilient material, at least on its wedge faces which will bear, in use, against the angled edge flanges of the sheets of material to be connected.

In order to ensure a rigid fluid-tight connection of the parts connected by the clamping device according to the invention, the wedge faces of the rod or of the longitudinal groove of the clamping member may have a longitudinal ribbing, or serrations directed towards the narrow side of the rod. Furthermore, the rod may have at the side which is, when the rod is in position in the clamping device, the outer

[ ]

side, a profiled longitudinal groove to receive a sealing strip which has lateral sealing flaps extending along and bearing against the sheets of material and which is pressed snugly against the sheets, either by its own resilience or by a difference of pressure on the opposite sides of the sheets.

A clamping device constructed according to the invention may also be provided on its outer side with fastening means, by means of which the clamping device may be fastened to another object. These fastening means may be constituted by, for example, threaded holes, depressions or projections on the outer faces of the clamping device, or the latter may be gripped and held along its outer side by a similar clamping unit connected to another object. With the clamping device according to the invention it is possible, in particular, to use threaded holes similar or identical to that for the screw acting on the rod, in order to attach any object. In this procedure short screws are used that are without effect on the functioning of the clamping device.

In order to ensure rigidity of the grooved clamping member, this member may have along its web a reinforced middle section.

Furthermore, it is particularly advantageous for the rods and clamping members to be used in prefabricated lengths. To maintain continuously the firmness of the reinforcing rib formed by the clamping device according to the invention, it is advantageous when several clamping members are arranged end-to-end, to displace the joins of the clamping members longitudinally in relation to any joins which there may be between the rods.

Further features and advantages of the invention will emerge from the following description of various embodiments of the invention given, by way of example only, with reference to the accompanying drawings. In the drawings:—

Figure 1 shows a cross-section through one form of clamping device according to the invention;

Figure 2 shows a similar cross-section through another embodiment of clamping device;

Figure 3 shows a cross-section through a further embodiment of the invention;

Figure 4 shows a cross-section through a clamping member which is reinforced centrally of its web;

Figure 5 shows a cross-section through a clamping device according to the invention, having wedge faces which are serrated;

Figure 6 shows a cross-section through a clamping device according to the invention, in which the clamping member is provided with a sealing strip;

Figure 7 shows a cross-section through a clamping member according to the invention, provided with fastening means of different kinds;

Figure 8 shows a cross-section of a clamping unit which is attached to the clamping member in one form of device according to the invention;

Figure 9 shows a cross-section of a clamping member according to the invention, which is screwed to another object and

Figure 10 is a diagrammatic elevational view of a silo which is assembled from individual metal sheets by means of clamping devices according to the invention.

Referring to Figure 1, the clamping device according to the invention shown therein comprises a grooved substantially U-shaped elongated clamping member 3 having a wedge-shaped inner profile and a rod 2 arranged therein with a similar shaped profile. The edges of the sheets are bent back through more than 90°, so that they have substantially the same angle of inclination relatively to the line of symmetry 8 as the inclined wedge faces formed on the rod 2 and on the clamping member 3. In applying the device, the screw 4 is first screwed upwards in a threaded hole in the clamping member, so that the rod 2 can move with play in the groove 9 of the clamping member 3 and so that there is enough room for the easy insertion of the edges of the sheets 1. After the edges of the sheets 1 have been inserted the screw 4 is screwed down; thus the rod 2 is pushed towards the open side of the groove 9 and so clamps the bent-back edges of the sheets 1 tightly between the opposed wedge faces. The angle of the wedge may conveniently be about 15°.

In the forms of clamping device according to the invention shown in Figures 2 and 3, the clamping member 3 has a groove 10, the wedge-shaped cross-section of which is so shaped that the width of the groove increases outwards. The cooperating rod 12 is provided with a corresponding wedge cross-section that tapers inwards. Whereas in the embodiment according to Figure 1, fastening of the bent-back edges of the sheets 1 in the clamping device is effected by the rod 2 being pressed outwards in the groove 9 of the clamping member 3, in the embodiments shown in Figures 2 and 3 clamping takes place by means of the rod 12 being drawn inwardly in the groove 10 of the clamping member 3 by means of the screw 11. The thread in which the screw 11 is received can be provided either in the rod 12 (see Figure 3), or in a nut which engages non-rotatably in a recess provided in the rod 12 (see Figure 2), the screw being inserted through a hole provided in the rod 12.

Figure 4 shows a form of clamping member for use in a device according to the invention, which member is particularly economical in material but which, nevertheless, ensures adequate firmness by virtue of the fact that the web 7 is reinforced.

Figure 5 shows one possible way of making

the bent-back edges of the sheets 1 engage particularly firmly in the clamping device and for simultaneously ensuring a particularly good seal at the clamping position. For this purpose the opposed faces of the rod and the clamping members are provided with serrations 13 and 14. The serrations are directed inwardly relatively to the hollow space of the clamping member, so that they act like barbs and effectively prevent the bent-back edges of the sheets 1 from slipping out. This feature is of particular importance when the parts of the rod or clamping member which are in engagement with the bentback ends consist of flexible or resilient material.

Figure 6 shows a further possibility for providing sealing at the clamping position. For this purpose the rod 2 is provided, along its outwardly directed free face, with a longitudinal groove 19 with which a sealing strip 18 is engaged. The sealing strip 18 has a portion having a profile matching that of the longitudinal groove 19, for snap-in insertion. The sealing strip 18 has two sealing flaps 20 which rest on the sheets 1 and are pressed snugly against them, either by their own resilience or by the excess pressure prevailing at the contact side. Such excess pressure, or at least a difference of pressure, is often present in the case of storage units such as silos.

In the simplest case the parts of the clamping devices consist of metal. Naturally other materials, for example, synthetic plastics, may be employed. In order to ensure adequate firmness, metal reinforcements may be incorporated in the parts when these are made of materials other than metal. It is also possible to assemble the clamping member 3 from an outer metal member with an inner layer of another softer material. Similarly, the inner rod 2 or 12 may have an outer layer of softer material. With such constructions, it is possible to ensure adequate firmness in the clamping connection, while nevertheless, allowing an appreciable saving of wear and tear on the clamped edges of the sheets of material 1.

Figure 7 shows how a clamping member according to the invention may be very simply provided with fastening means. It will be clear that, by means of depressions 15 or projections 16, or with a combination of these, the clamping member may be very simply fastened to another object provided with complementary projections or depressions. Naturally it is also possible to envisage threaded holes in the clamping member or in the rod, so that other structural parts may be attached by screws.

As Figure 8 shows, with the form of clamping device according to the invention shown in Figure 1, it is also possible to fasten the clamping device to a clamping unit 17 in a manner analogous to that in which the rod 2 is held in the clamping member 3.

Figure 9 shows a particularly advantageous method of fastening by means of threaded

holes. Here a threaded hole identical with or similar to that previously mentioned as being envisaged for the reception of screw 11 is used to screw on another structural part 21. The additional screws 23 employed for this purpose are chosen to be of relatively short length such that, bearing in mind the thickness of the part 21 and of the washer 22 which may be employed, the screws cannot reach the rod 2. The screws 23 may then be screwed home without damaging the rod 2. Enough additional threaded holes are provided in the web 7 of the clamping member 3 for a sufficient number of additional screws 23 to be used. A similar arrangement may be adopted with the forms of member shown in Figures 2, 3 and 7. Threaded holes may likewise be formed in the rod 12, as is already clear from the embodiment shown in Figure 3.

The fastening devices shown in Figures 7, 8 and 9 are, for example, employed to fasten the lower or upper device of a series of separate clamping devices to a foundation or final constructional unit. For example, in the silo shown in Figure 10, a foundation ring 24 is provided on which both the lowest devices of the series 25 of separate clamping devices according to the invention and the lower edges of the individual metal sheets 1 (from which the outer skin of the silo is made) are fastened. The sheets 1 are connected along their vertical edges by means of clamping devices according to the invention. The metal sheets are delivered to the building site in the required lengths, for example between 8 and 10 metres and with a width of about 800 mm., their edges being already bent back. The width of the bent-back edges may be, for example, 15 mm. The sheets are laid out on the ground and connected to each other with the clamping devices. The sheets joined together in this way then have a curve imparted thereto by engaging assembly rings 26 therewith. In carrying out this operation, the assembly rings 26 may be screwed to the clamping devices, for example in the manner shown in Figure 9, so that a structurally rigid cylindrical cladding for the silo results. The final seam of the silo wall is then closed, likewise by means of the clamping devices. With this method of assembly it is possible to construct any diameter of silo that may be desired. There is no requirement to curve the silo wall beforehand, as curvature is provided automatically during assembly; this also leads to simpler stock control.

With rectangular containers or silos the metal sheets are handled in flat form. The width of the bent-back side-wall sheets is in that case between 200 and 400 mm. The sheets are cut to size longitudinally along the sheet to correspond to the width of the container and are assembled at the building site to form container walls. Here too the advantages of the clamping device according to the invention become fully apparent: simpler transport,

simple assembly and no drilling or welding at the building site.

- It is possible for the invention to be embodied in other ways than those described, without going outside the scope of the invention, as defined by the appended claims.

**WHAT WE CLAIM IS:—**

1. A clamping device for connecting two sheets of material at two adjacently positioned laterally projecting edge flanges thereof, comprising a rod for positioning between the edge flanges so as to form a reinforcing rib, which rod has a wedge-shaped cross-section, an elongated generally U-shaped clamping member defining a groove with inclined side walls receiving the rod with play so that the edge flanges of the sheets are insertable between opposite side walls of the groove and the rod, and a screw extending through the web of the U-shaped clamping member for exerting a force on the rod urging it in the direction towards the narrower side of said groove.
2. A clamping device according to claim 1, characterised in that the screw acts in the plane of symmetry of the wedge-shaped cross-section of the rod.
3. A clamping device according to claim 1 or 2, characterised in that the side walls of the groove and the rod diverge in the direction towards the outside of the groove, and that said screw exerts a pulling force on said rod.
4. A clamping device according to claim 1 or 2, characterised in that the side walls of the groove and the rod converge in the direction towards the outside of the groove, and that said screw exerts a compressive force on said rod.
5. A clamping device according to any of claims 1 to 4, characterised in that the side walls of the rod and the groove lie at an angle of substantially  $15^\circ$  with the plane of symmetry.
6. A clamping device according to any of claims 1 to 5, characterised in that said rod and/or said clamping member consists or consist of metal having a layer of relatively soft material applied to their side walls.
7. A clamping device according to any of claims 1 to 6, characterised in that longitudinally extending serrations are provided on the side walls of said rod and/or the side walls of the groove of the clamping member, such serrations having apices pointing towards the narrower side of the groove.
8. A clamping device according to any of claims 1 to 7, characterised in that the face of the rod directed towards the outside of the groove is provided with a profiled groove extending longitudinally in the plane of symmetry serving to receive and secure by snap action the stem of a T-shaped sealing strip.
9. A clamping device according to any of

claims 1 to 8, characterised in that fastening means are provided at the outer side of the web of said clamping member for serving to secure another member to said clamping device.

10. A clamping device according to claim 9, wherein said fastening means comprises depressions and/or projections provided at the outer side walls of the clamping member and for cooperating with complementary projections and/or depressions provided on the other member.

11. A clamping device according to claim 9, wherein said fastening means comprises threaded bores provided in the web of the clamping member for receiving screws terminating substantially at the bottom of the groove, said threaded bores being identical with threaded bores in such web receiving the screw acting on the rod.

12. A clamping device according to claim 9, wherein said fastening means comprises a U-shaped clamping element of similar shape to the clamping member wedgingly urged against the lateral outer side walls of the clamping member by screws extending through threaded bores provided in the web of such clamping element and bearing against the web of the clamping member.

13. A clamping device according to any one of the preceding claims, characterised in that the web of the clamping member has a reinforced central section.

14. A clamping device according to any one of the preceding claims, characterised in that the rods and clamping members are formed in pre-fabricated lengths.

15. A structure incorporating the clamping device according to any one of the preceding claims, characterised in that several rods and clamping members are used in a row, the joints between the clamping members being displaced longitudinally in relation to the joints between the rods.

16. A clamping device for connecting sheets of material, substantially as herein described with reference to and as shown in any of Figures 1 to 3, 6 or 9 of the accompanying drawings.

17. A clamping device according to claim 16, modified substantially as herein described with reference to and as shown in any of Figures 4, 5, 7 or 8 of the accompanying drawings.

18. A structure comprising sheets of material connected by a clamping device according to any one of claims 1 to 14.

19. A structure comprising sheets of material connected by clamping devices according to claim 1, the whole substantially as herein described with reference to and as shown in Figure 10 of the accompanying drawings.

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Fig. 1

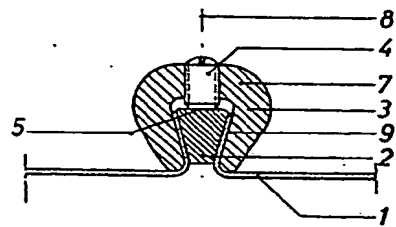


Fig. 2

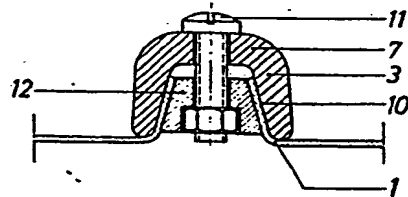


Fig. 3

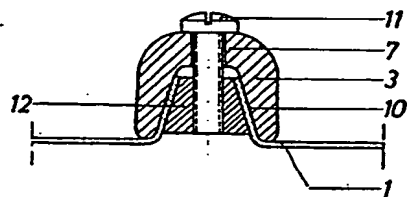


Fig. 4

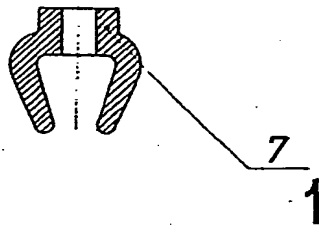


Fig. 5

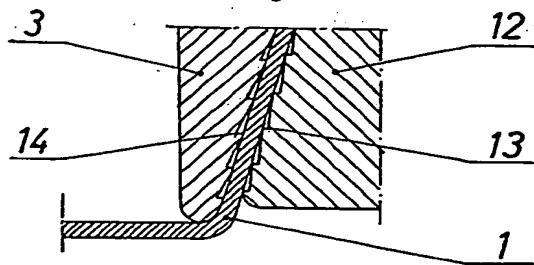
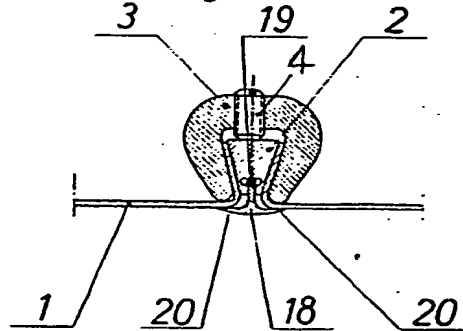


Fig. 6



8  
4  
7  
3  
9  
2  
1

11  
7  
3  
10  
1

11  
7  
3  
10  
1



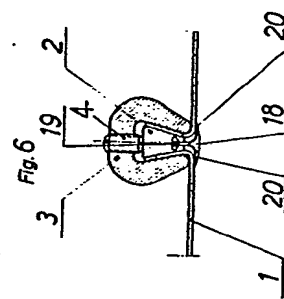
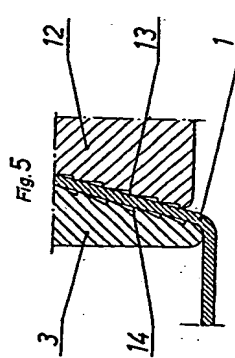
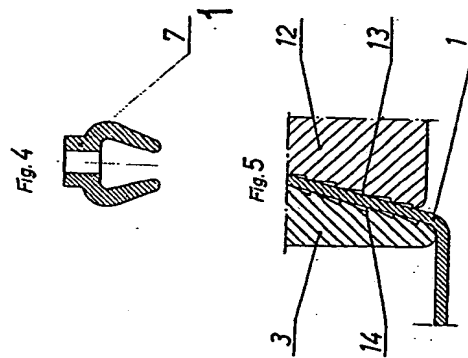
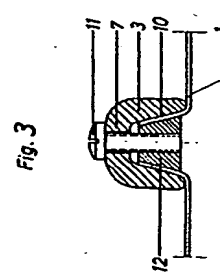
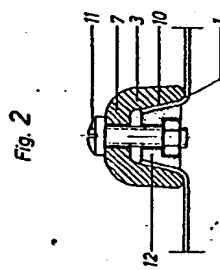
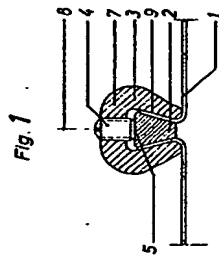


Fig. 7

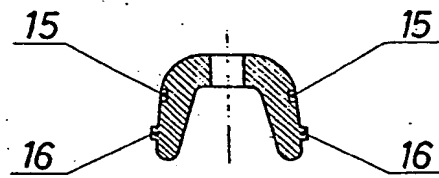


Fig. 8

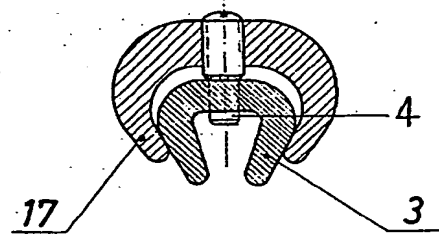
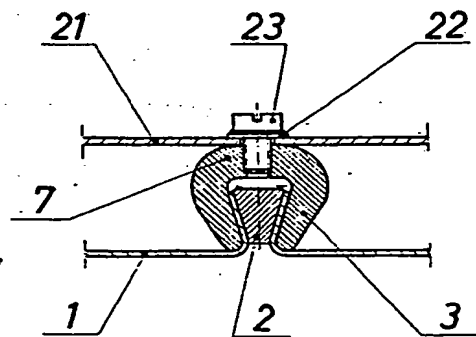


Fig. 9



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COMPLETE SPECIFICATION

4 SHEETS

*This drawing is a reproduction of  
the Original on a reduced scale  
Sheets 3 & 4*

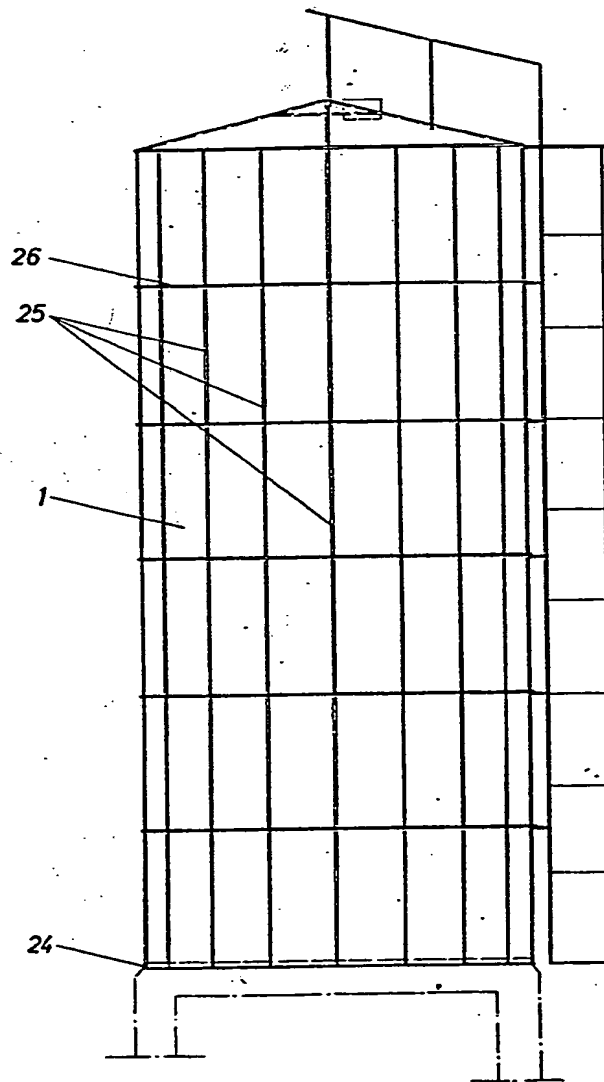


Fig. 10

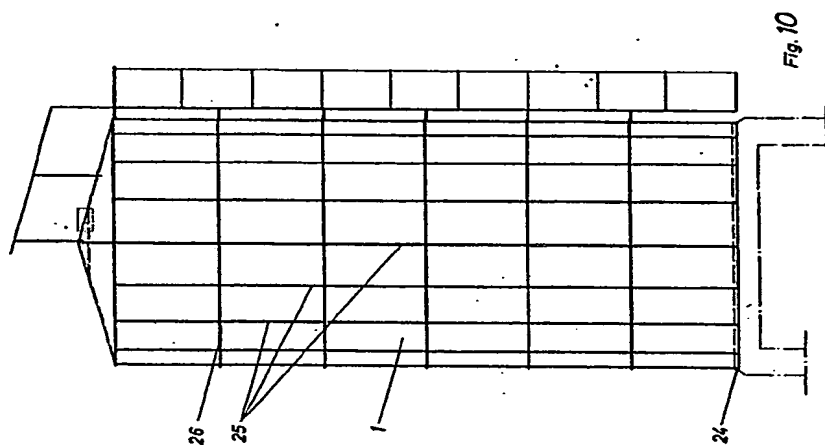
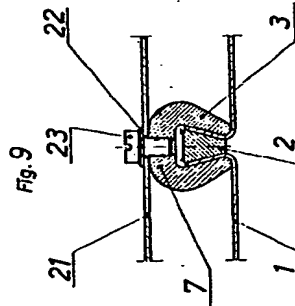
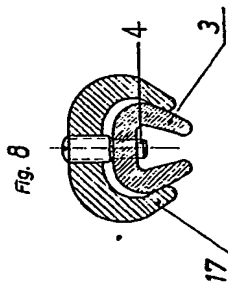
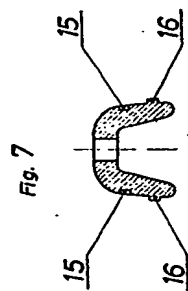


Fig. 10